THE TANKS OF WORLD WAR I

The History and Legacy of Tank Warfare during the Great War

Charles River Editors

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By Charles River Editors

A Russian tank

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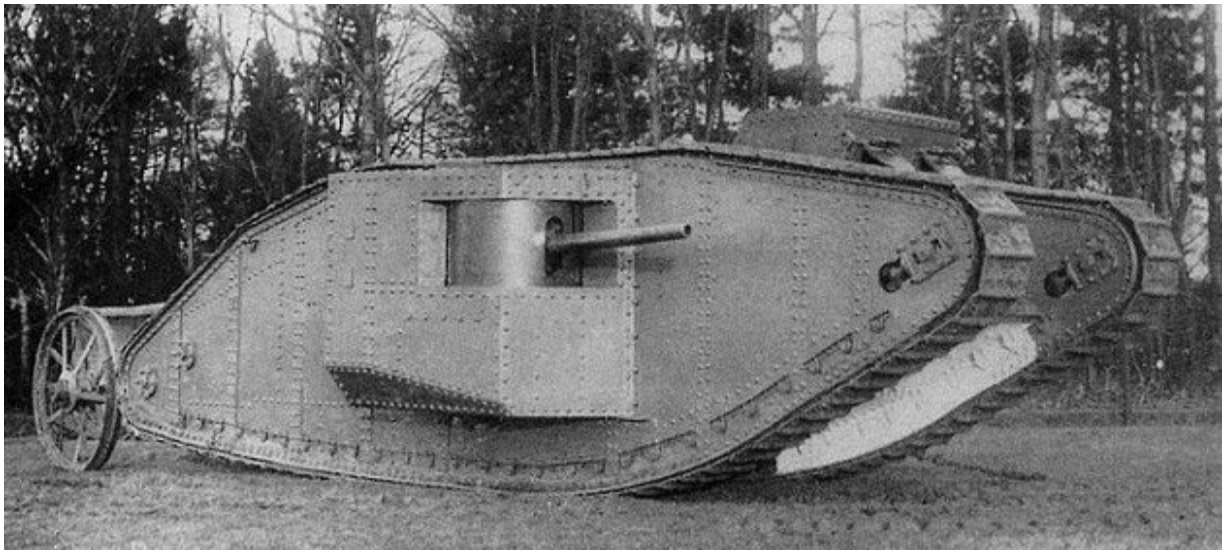
Introduction



Mark I-IV Tank

Tank Warfare in World War I

World War I, also known in its time as the "Great War" or the "War to End all Wars", was an unprecedented holocaust in terms of its sheer scale. Fought by men who hailed from all corners of the globe, it saw millions of soldiers do battle in brutal assaults of attrition which dragged on for months with little to no respite. Tens of millions of artillery shells and untold hundreds of millions of rifle and machine gun bullets were fired in a conflict that demonstrated man's capacity to kill each other on a heretofore unprecedented scale, and as always, such a war brought about technological innovation at a rate that made the boom of the Industrial Revolution seem stagnant.

Since the Industrial Revolution, arms and materiel output had increased by orders of magnitude, as had the quality and uniformity of the products. Several developments had already taken place in the years building up to the conflict, stepping stones towards the vast escalation in military innovation which took place immediately prior to and during World War I. Chief among these was the invention of smokeless gunpowder, which took place concurrently among several powers between 1890 and 1905. This was a crucial development, as it eliminated the literal "fog of war" which in vast quantities obscured the battlefield entirely and on an individual level both gave away the position of

marksmen and made it impossible for them to fire accurately unless they moved away from their own smoke-cloud. Further innovations included the adoption into service of the first belt-fed machine guns, predecessors of those which would wreak such slaughter in the trenches, and the development of cannon which did not roll backwards after each shot as 19th century pieces did, but remained fixed in place.

The arms race before the war and the attempt to break the deadlock of the Western and Eastern Fronts by any means possible changed the face of battle in ways that would have previously been deemed unthinkable. Before 1914, flying machines were objects of public curiosity; the first flights of any account on rotor aircraft had been made less than 5 years before and were considered to be the province of daredevils and lunatics. By 1918, all the great powers were fielding squadrons of fighting aircraft armed with machine-guns and bombs, to say nothing of light reconnaissance planes. Tanks, a common feature on the battlefield by 1918, had not previously existed outside of the realm of science fiction stories written by authors like H.G. Wells. Machine guns had gone from being heavy, cumbersome pieces with elaborate water-cooling systems to single-man-portable, magazine-fed affairs like the Chauchat, the Lewis Gun and the M1918 BAR. To these grim innovations were added flamethrowers, hand grenades, zeppelins, observation balloons, poison gas, and other improvements or inventions that revolutionized the face of warfare.

These technological developments led to an imbalance. Before the introduction of the man-portable light machine gun (which took place in the second half of the war), not to mention tanks (which also joined the fight late in the game), defensive firepower vastly outweighed offensive capability. Massed batteries of artillery, emplaced heavy machine guns, barbed wire entanglements, and bewildering fortifications meant that ground could not be taken except at incredible cost. This led to the (somewhat unjustified) criticism famously leveled at the generals of World War I that their soldiers were “lions led by donkeys”. Certainly, every army that fought in the Great War had its share of officers, at all levels of command, who were incompetent, unsuitable, foolish, or just plain stupid, but there were plenty of seasoned professionals who understood their job and did it well. The main problem facing commanders in the war was that there was such a bewildering array of new armaments, with such vast destructive potential, that previous military

doctrines were virtually useless. Cavalry, which had been expected to play a major role both as reconnaissance and as "mounted infantry", operating in much the same way as airborne and mechanized troops would later to rapidly outflank enemy positions, quickly proved useless. Frontal infantry assaults were cut to shreds by enemy defensive fire, but there seemed to be no major alternative. Ground had to be taken, even if at great cost, and to do so, more destructive weapons were devised, tested and deployed.

As a result, World War I was the first truly industrial war, and it created a paradigm which reached its zenith with World War II and towards which virtually all equipment, innovation and training were dedicated throughout the Cold War and the remainder of the 20th century. To this day, modern warfare remains synonymous with tanks and mass infantry battles, although a confrontation of this nature has not occurred (except briefly during Operation Desert Storm) since World War II.

One of the most important breakthroughs in military technology associated with World War I, and certainly the one that continues to capture the public imagination, was the introduction of a war machine that came to dominate the face of land battles throughout most of the 20th century: the tank. As a concept, it was not revolutionary; in fact, it harkened back to classical antiquity and to the Middle Ages, such as the covered battering rams and *testudos* which had made frequent appearances on ancient battlefields. In essence, it was designed to solve the age-old problem of protecting infantry from enemy projectiles while remaining mobile.

The development of both modern artillery and machine guns, as well as the stalemate engendered by heavy fortifications and entrenchments, had hamstrung the mobility of infantry and cavalry and also left them both utterly vulnerable to defensive firepower. Since they were incapable of replying in kind, the tank was designed to bridge that gap. The tank's armor, thick enough to withstand lateral fragmentation from exploding shells (although not direct hits) also made it virtually invulnerable to enemy rifle and machine gun fire, and its large tread meant that it could bridge trenches which would, at the very least, have delayed infantry substantially. As for the barbed wire entanglements and obstacles that severely delayed infantry and exposed them to enemy fire, tanks could simply drive right through it.

Various armies had flirted with the concept of a tank prior to World War I, but advances in metallurgical techniques (allowing for suitably solid and relatively lightweight armor) and in mechanical engineering (which allowed for the construction of a powerful engine capable of driving such a mass) finally made its development and deployment possible, as did the development of treaded track (initially for agricultural use in tractors). It was the British (at the instigation of Winston Churchill) who pioneered the "landship", but the French soon followed suit with their own designs. Ironically, Germany, which would subsequently become famous for panzers and blitzkrieg warfare, was late in taking up the idea. During World War I, the Germans continued to rely on other techniques, and they produced less than two dozen models for battlefield use.

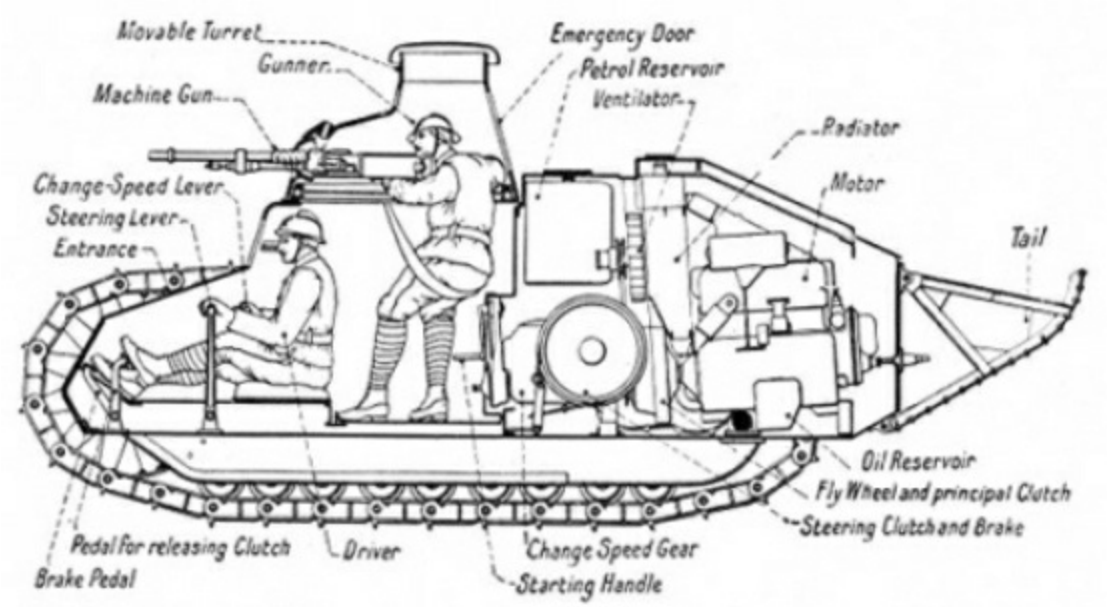
The tanks of World War I, revolutionary (and initially terrifying) as they were, had their limitations. A standard tank would literally consume its own weight in spare parts, and they were painfully slow compared to more modern iterations. They were also lightly armed – usually with machine guns or light guns at most – and some poorly designed models tended to "ditch" themselves, sometimes irretrievably, in wider trenches. However, as a mobile bastion for infantry to shelter behind in the advance, and as a psychological weapon, they were significant.

The most iconic tank of World War I, the Mark I (which later went through several iterations, although only Mark I-IV saw combat during the war), was employed by a number of armies. The Mark I was produced by a specially designed government committee with the full cooperation of all services and British industry, resulting in a cohesive and practical whole. Over 30 feet long and weighing just under 30 tons, the Mark I came in two versions: a "male" (armed with side-mounted turret guns) and a "female" that didn't have the guns. Crewed by 8 men, it could achieve the rather unspectacular speed of 4 miles per hour, and its 60-gallon tank gave it an operational radius of just under 24 miles thanks to its thirsty Daimler-Knight 6-cylinder, 16 liter straight petrol engine, which generated 105 horsepower. The tank's armament was two 6-pounder light guns for the male, plus three .303 Hotchkiss machine guns, while the female version carried four .303 Vickers machine guns instead of artillery and a .303 Hotchkiss machine gun. The Mark I-IV, of which over 2,000 models were produced for wartime action, saw service at the Somme, Fleurs-

Corciette and Amiens on the Western Front, and during both battles of Gaza in North Africa against Turkish forces.

The British tanks suffered from a number of issues, not least of which was the development of armor-piercing bullets by the Germans in the latter part of the war, and due to mechanical failure or enemy action, only a third of them usually reached enemy positions. However, those that did reach that far almost always contributed significantly to a final victory. A thousand were ordered for later British use, but the end of the conflict brought wartime production to a standstill.

France's initial forays into tank design were not an unqualified success. Unlike the concerted efforts made by the British Armed Forces and the various private companies involved in production, the French initially operated at cross-purposes, thus producing a number of ill-starred early efforts which suffered from some serious design flaws. By 1917, however, thanks primarily to the efforts made by Renault to come up with a successful design, the French were able to field significant numbers of small, agile, and lightly armored tanks. The French envisioned having these tanks operate as a "swarm", a tactic unlike the British but one that was adopted by the Americans, who also purchased and manned the Renault FT. Crewed by just two men, the Renault FT was a little over 15 feet long and weighed just over 6 tons (a third of the Mark I-IVs). It had an operational range of around 40 miles thanks to its 4.5 liter, 4-cylinder Renault petrol engine. The Renault FT was significantly faster than the British tanks, allowing it to operate with a tactical agility reminiscent of what the previous century's cavalry had been able to achieve, and it was also mechanically more reliable. It was far less heavily armed, however, as its two variants being either one single light gun or a single .303 machine gun. Designed to be an agile, fast-hitting screen for maneuverable warfare, over 3000 were produced for use by the French and Americans.



DIAGRAMMATIC SECTION OF A FRENCH LIGHT (OR "MOSQUITO") TANK.

Renault FT "Mosquito" Light Tank

Unlike the remarkable advances the Germans made developing zeppelins,

aircraft, heavy artillery and machine guns, they were reluctant to develop tanks and never considered doing so until they found themselves on the receiving end of tank assaults at the Somme. The final product of their efforts was the A7V, envisioned more as an armored troop transport than as an offensive vehicle. Only 20 were eventually produced for battlefield service, but the Germans also employed captured Allied tanks. They saw action on the Western Front at Villers-Bretonneux, where they faced off Against allied tanks in the first tank-on-tank battle, and in other engagements, including the Battles of Aisne and the Marne.

The A7V

The A7V was over 20 feet long and weighed 33 tons, more than even the heaviest Mark I-IVs. It also carried a relatively heavy 57mm gun and six machine guns, and it was powered by two engines: Daimler-Benz 4-cylinders capable of 100 horsepower apiece. This gave it an operational range of between 20-50 miles depending on terrain and fuel tank size, and a top speed of 9 miles per hour on road and 4 miles per hour cross-country. The A7V carried a full complement of 18 men, and in many ways it was a superior

machine to its equivalent, the British Mark I-IV, since it was capable of slightly greater speeds and more heavily armed. However, German reluctance to use tanks as a viable battlefield advantage meant that the Germans were never able to field anywhere near the number of vehicles the Allies were.

The Tanks of World War I: The History and Legacy of Tank Warfare during the Great War analyzes the technological advancements in tank warfare and its impact on what was the deadliest conflict in history up to that time. Along with pictures of important people, places, and events, you will learn about World War I tanks like never before.

The Tanks of World War I: The History and Legacy of Tank Warfare during the Great War
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The Genesis of the Tank

History books often say that World War I saw many military innovations, including trench warfare, barbed wire, underground mining, airplanes, poison gas, tanks, and much more. While it is true many of these developments came into their own during war, most had been in use before that time. Undermining enemy trench systems with explosives dated back centuries, and the Russo-Japanese War (1904-1905) saw several developments, such as the widespread use of trenches and the rise in dominance of the machine gun, two developments to which European military planners should have paid attention. As for airplanes in warfare, the first use of the new machines was by the Italians in their invasion of Ottoman-controlled Libya in 1911-1912. Poison gas had been used in various forms since ancient times.

The only true innovation of World War I was the introduction of the tank. The automobile had only become common in the previous decade, and performance was such that few military planners took them into account. With the needs of the Great War, however, all major powers looked into using armored vehicles to turn the tide of battle, and it would change military strategy and tactics forever.

The development of tanks was a product of necessity. At the opening of the war in August of 1914, most politicians and military leaders thought it would be a quick conflict, a matter of a few months at most. No one dreamed it would degenerate into years of nearly static trench warfare as it did on the Western Front and the Italian Front. This lack of foresight can be seen in the preparations of the armies themselves. The men were not equipped with metal helmets to protect them when looking or firing over the parapet of a trench, and the artillery was provided with only a relatively small number of high-explosive shells. Instead, shrapnel shells were the most common type sent to the front, and they proved to have little effect against barbed wire (also in short supply in the opening months of the war) or against men hiding in entrenched positions. Thus, when the war ground down to the stalemate of opposing trenches in Belgium and France, both the Allies and the Central Powers realized they needed to vastly expand their potential to undermine the enemy's positions.

As early as December 1914, just months into the war, Maurice Hankey, Secretary of the Committee for Imperial Defence for the British Empire, drafted a memo discussing the possibility of using armored vehicles to help break the deadlock. While armored cars were already in use, they ran on wheels, and given their extra weight, they quickly bogged down in the muddy conditions of the Western Front. They also could not pass through barbed wire entanglements or over trenches. Something entirely new was needed.

Hankey

It fell to British Army Colonel Ernest Swinton to demonstrate the first tank prototype. He had been in correspondence with Hankey and had discussed how a vehicle with caterpillar tracks (already widely in use in army transport) and fitted with armor and weapons could be of service on the front. He demonstrated an American Killen-Strait tractor to a group of high-ranking politicians and military officials in June 1915. In the audience were First Lord of the Admiralty Winston Churchill and David Lloyd George, who would become prime minister later that year. Both were impressed by the tractor’s ability to push through barbed wire, the bane of every infantry's assaults.

Swinton

After consulting further with Swinton and Hankey, Churchill established the Landships Committee to develop the idea of arming and armoring a tractor chassis. Thus, it fell to the Royal Navy to oversee the development and deployment of the first "landships." The Royal Navy were innovators in the use of armored cars to protect their bases and airstrips in Belgium and were thus seen as the branch of service with the most experience where they were concerned.

Churchill

The government commissioned Lieutenant Walter Wilson of the Naval Air Service and William Tritton of William Foster & Co. to produce the first landship prototype. Swinton stipulated the end result be able to travel at four miles per hour (6.4 kph) with a range of 20 miles (32 km), climb an obstacle five feet (1.5 m) high, cross a five foot wide trench, be bulletproof, and armed with two machine guns. Since the general mockup looked like an oversized water tank, the codename for the secret weapon became "tank."

The company worked remarkably fast, managing to create a working prototype that impressed the government with only the vaguest of instructions. On January 29, 1916, the prototype, known as "Mother," was demonstrated on

the grounds of Hatfield House in Hertfordshire. The machine was odd-looking, with a rhomboid profile and tracks that went all the way around its sides and stuck out in front of and behind the cab. Trailing behind it on a frame was a pair of "steering wheels" able to turn the tank and move it from side to side, a bit like a rudder on a ship. The tracks were not independently run like on a modern tank, where one is able to go forward and another backward, but the driver was able to simulate the effect at the cost of putting great strain on the works, applying the brakes on one track at a time in order to make a slow turn.

The engine was in the center of the cab, thus making a turret impractical, and the armament was fixed to a sponson, a projection on the side of a tank, boat, or airplane used to house a weapon. Sponsons were already in widespread use on warships, showing the naval influence on the early design.

What most impressed observers about this new machine was its maneuverability, namely its ability to ride across trenches, through muddy ground, up and over obstacles, and through barbed wire entanglements without trouble. The government immediately ordered 100 of them and would soon increase its order.

When she went into mass production, Mother would become the famous Mark I British tank, the first true tank to see combat. Weighing in at 8 tons with a crew of eight, it measured 32'6" ×13'2" ×7'11" (9.92×4×2.4 m) in length, width, and height. It was able to move at a maximum speed of 3.7 mph (5.95 kph) with a range of 28 miles (45 km). Its considerable length, aided by its unique rhomboid shape, meant it was able to cross a trench 11'6" (3.5m) wide, which was an impressive achievement.

The machine had 6 mm (.23 inch) armor on most of its body and 10 mm (.4 inch) armor on vital areas, such as near the twin petrol tanks, ominously located on either side of the driver. This armor was relatively thin and light, and while it protected against small arms fire, a direct hit—or even a near miss by a field gun—was sure to puncture it.

Half of the tanks were fitted with a pair of 6-pdr (57 mm), 40-caliber, quick firing cannon and four Hotchkiss 7.62 mm machine guns. These were dubbed the "male" tanks. The "female" tanks substituted a pair of heavy Vickers .303 machine guns for the cannon, plus two more Vickers and a Hotchkiss. Each

crewman was armed with a pistol, so the tank had several loopholes through which to fire. There was even a loophole on the sloping bottom of the front of the tank so the driver would be able to shoot downward into trenches as he crossed them.

The enormous stresses placed on the tracks meant they were prone to wearing out after about 30 miles (48 km). Moreover, the hatches were undersized, thus making it difficult to get out in a hurry, so if the tank ever caught fire, which sometimes happened when hit by field artillery, there was little chance of the crew escaping. More annoying to the crew on a daily basis were the heat and noise of the engine; it was often impossible to communicate with someone even when shouting into their ears, and the temperature in the cabin was known to rise to 120 degrees Fahrenheit (50 degrees Celsius). The engine also had the bad habit of leaking carbon monoxide. On top of all that, visibility through the small vision slits and periscopes was poor, and ventilation was bad.

Andrew Skudder's picture of a prototype of the Mark I

By the end of the summer of 1916, the Mark I was being produced at the rate of 25 per week and training had begun in earnest. After initial crew training in England, the Mark I vehicles were shipped to France to train with the infantry units along which they would fight. The ideal tank unit, often not managed in practice, consisted of three male and three female tanks, plus an additional tank in reserve.

On September 15, 1916, the first British tank saw action at the Battle of Flers-Courcelette, part of the Somme campaign. The objective was a pair of villages that gave the battle its name. A D1 tank commanded by Captain H. W. Mortimore moved forward, becoming the first tank to see action. Three tanks were supposed to be in the assault on that part of the line, but the other two were delayed.

This was typical all along the line. Initially, 49 tanks were supposed to go into action that morning, but only 32 were ready at zero hour. Five got stuck in trenches or shell craters, nine broke down, and nine moved too slowly to keep up. To their dismay, the crews found that some of the tanks were not fully bulletproof. Bullets hitting the vision slits broke the thick glass, sending slivers into the crewmen's eyes. Bullets hitting the metal sometimes sent spall flying around the interior of the cabin and even punched through the metal plate in the female tanks. The steering tail was found to be pretty much useless when several broke off in the field and the crew realized the tanks maneuvered just as well without them.

Nevertheless, those few tanks that actually made up the vanguard of the attack threw the Germans into a panic, and many men fled at the sight of these lumbering metal beasts. While the attack was only a modest success, the tanks gained the confidence of Sir Douglas Haig, British Commander in Chief in France, who immediately sent an order for 1,000 more.

Haig

Four Mark I tanks on the battlefield in September

Mark I vehicles saw regular use in the British sectors, but it was a piecemeal affair in which demand far exceeded supply. They proved their worth in numerous small engagements by taking limited objectives, and the British infantry gained confidence whenever they heard the machines were to join the troops in an assault.

The tank crews also proved their heroism. On November 13, a female tank commanded by Lt. H.W. Hitchcock got stuck in a shell hole. Taking fire, Hitchcock and two of his men were wounded, and the Germans surrounded the tank, firing at it from all sides. Corporal Taffs took over, managed to get the tank free, and continued on to the German second line, where the tank promptly fell through the roof of a German dugout. It was now properly stuck, and at such an angle that it couldn't fire. Once again, the Germans surrounded it and poured machine gun and grenade fire at the helpless tank. Taffs sent out a carrier pigeon with a message calling for help, and about an hour later, the British infantry came to its rescue. All surviving members of the crew earned military medals for their valor.

In January of 1917, eight tanks were sent to join the Egyptian Expeditionary Force in their push into Ottoman-held Palestine. While the heat knocked out many of the tank crews, they nevertheless provided good service against the Turks. To their credit, the Turks stood up to the new weapons more bravely than the Germans initially had, taking some of them out with accurate field gun fire.

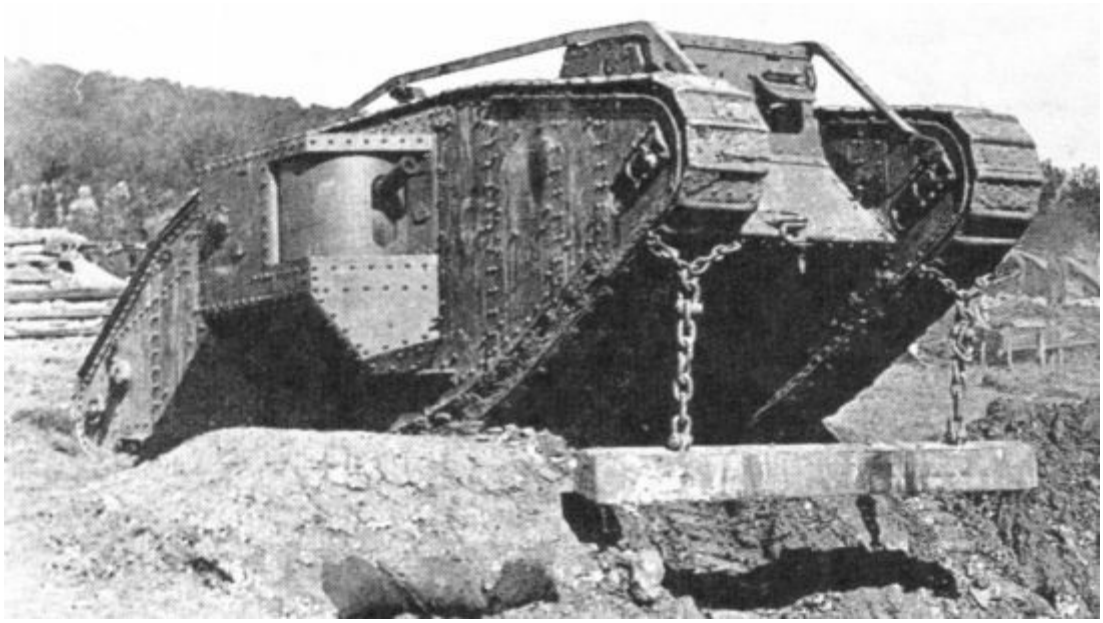
General Haig's order for a thousand new tanks and the experience of the Mark I's deficiencies in the field led to modifications of the original model and the introduction of the Mark II. While the Mark II retained the same general shape and features as the Mark I, there were a number of important modifications. The steering tail was dispensed with, and the cabin was narrowed to accommodate wider tracks. There were also various experiments with changing the steering mechanism, which hd taken four men to run in the Mark I. The Mark II needed two drivers, one to operate the primary gearbox and the other, who doubled as the commander, operated the brakes. Helping them were two gearsmen who operated the secondary gears of each track. Oddly, this cumbersome arrangement wouldn't be replaced until the Mark V model. Though it had been meant only as an experimental model and was only provided with a thin armor plate unable to stop even machine gun fire at short range, the Mark II did see some combat, with 50 units being sent to fight at the Battles of Arras and Bullecourt in April and May 1917.

The next model was the Mark III. One important innovation was the introduction of a ball mount at the front of the cabin to support a Lewis machine gun. Lewis guns were also put on the sponsons on female tanks. Since the Lewis gun was a much smaller weapon and was air-cooled rather than water-cooled, it allowed the sponsons to be smaller, thereby reducing weight. Two Lewis guns were fitted onto each sponson, allowing a full 180 degrees of fire. It is unclear if any units of this model actually saw combat.

One could look at all three initial Mark models as being experimental, with only the Mark I having been tested extensively in battlefield conditions, but the Mark IV changed all that. A culmination of more than a year of testing and experience, this model became the Britain's first main battle tank, showing an ability in the field that rewarded the high command's enthusiasm for the entire tank project. It was this model that would meet Haig's call for a thousand more

tanks.

The Mark IV retained the same basic design of the previous models. It measured 26’5” ×13’7” ×7’11” (8×4.2×2.4 m). The male weighed 28.4 tons and the female 27.5 tons. Its maximum speed was 4 mph (6.4 kph) with a range of 35 miles (56 km). It was able to cross an 11’6” (3.5 m) trench. Its crew of eight served two 6-pdr (57 mm), 23-caliber, quick-firing guns and three .303 caliber Lewis machine guns on the male tank, while the female had five Lewis guns. The cannons were shorter than those in previous models, following complaints that longer guns were prone to clogging with mud should the tank leaned too far forward on rough terrain. The Lewis guns, too, were smaller than the previous models had used. The Mark IV retained the Mark III’s ball-mount for a Lewis gun at the front of the cabin. Armor was 12 mm (.47”) thick at the front and 8 mm (.31”) along the sides. The bottom, top, and rear only had 6 mm (.24”) armor. This thicker front armor turned out to be proof against the new, German, armor-piercing ammunition, known as the “K round,” being issued to riflemen.



A Mark IV tank

One significant improvement was the fitting of a silencer on the exhaust system, which greatly reduced noise in the cab and allowed the crew to actually speak to one another rather than using hand signals. The silencer also reduced the amount of fumes emitted from the vehicle, thus making it less

visible in the field.

Production began in March 1917, and a total of about 1,200 were completed. The Mark IVs thoroughly proved themselves in the field, participating in almost every battle on the Western Front from their inception in the summer of 1917 until the end of the war. They also saw service on the Palestine Front at the Third Battle of Gaza on November 1, 1917.

The final, large tank to see service in the British Tank Corps was the Mark V, which had mostly replaced the Mark IV by the summer of 1918. Superficially identical to the previous model, the important differences were on the inside, with its main advantages over previous models being a more powerful engine and better steering. The Marks I-IV had been underpowered and awkward. Their Daimler 105hp engine simply was not adequate for the task, yet there was no room in the vehicle for a more powerful engine.

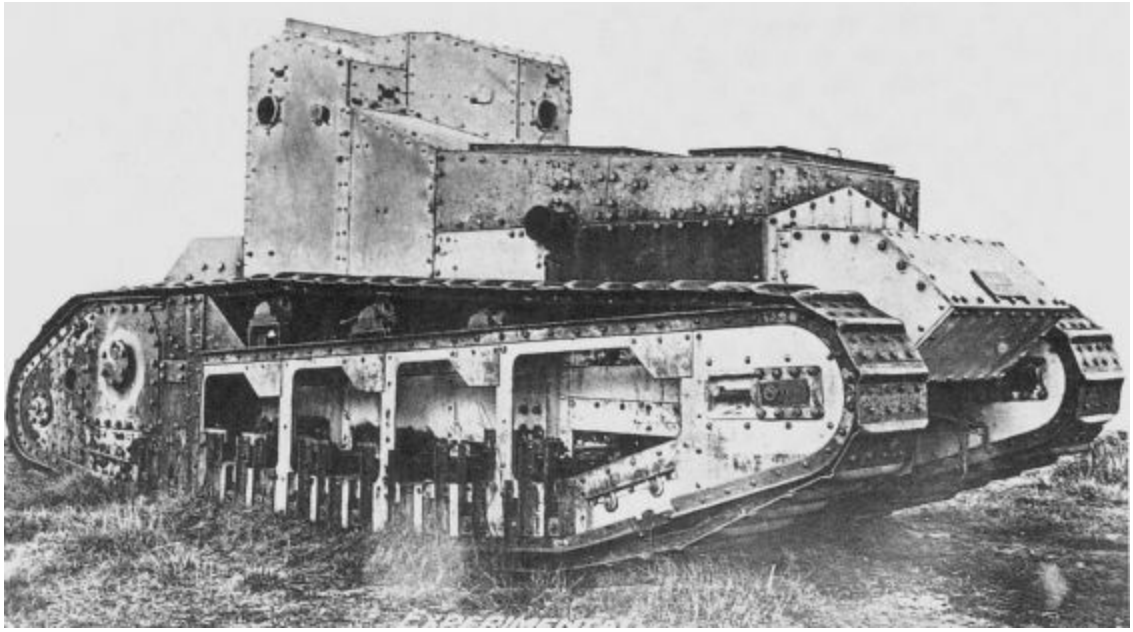
The Mark V had a compact, 150 hp engine designed specifically for it. Not only did the new engine allow for greater speed, but the design was superior, resulting in a much smoother ride. Larger gas tanks extended the range of the tank to 45 miles (72 km). The more efficient steering system—which included independent steering for each track—meant the driver would be able to steer the vehicle all on his own and without help, allowing the other seven members of the crew to perform their assigned duties uninterrupted.

A Mark V

A variant, dubbed the Mark V*—the asterisk being used by the Royal Artillery to note a modification to a design—was introduced in late 1917 in order to bridge the wider trenches the Germans had been digging to protect themselves from tank attacks. The variant measured six feet longer than

previous models and weighed four tons more, reducing its speed and maneuverability. Nevertheless, high command was satisfied enough with their performance to order 700 of them. The rear of the cab had sloping front and rear plates rather than vertical ones and ball-mounted Hotchkiss machine guns on both of them. These were used to fire into the upper stories of houses and against aircraft, although visibility inside the tank was such that it was doubtful whether a crew ever downed an airplane. The longer cab was able to carry up to 15 infantrymen and two machine guns that could be dropped off to men in captured trenches.

Late in the war, the British also created a smaller, quicker tank. Officially named the Medium Mark A—popularly known as the Whippet, named after the fast hunting dog—it featured a low chassis and a fixed polygonal turret set off to the left side. Instead of turning, the turret had a Hotchkiss .303 machine gun fixed to the front, left, right, and back. The Whippet measured 20'×8'7"×9' (6.1×2.61×2.74m). Its top road speed was 8.3 mph (14 kph) with a range of 80 miles (130 km). It weighed 14 tons and could cross trenches 10 ft. (3 meters) wide. Its armor ranged from 5 to 14 mm (.2-.55") but was of rather inferior grade and vulnerable to armor-piercing rounds. The tank had a crew of three, composed of a driver, commander, and gunner. A prototype tested in March of 1917 performed so well that production immediately started on an order of 400 units, of which only 200 had been finished before the end of the war. The first few made it to the Western Front in December of 1917.



The Whippet

The Whippet was a bit shaky in its maneuvering but clearly superior to the heavier Mark tanks. With an engine for each track, the driver was able to steer two ways. For example, by turning the steering wheel to the left, the driver was able to speed up the right-hand engine and slow the left. He could also make quicker turns by shifting the gears of one engine but not the other, although it was at the risk of stalling. Right turns could be made by putting one track in reverse and the other in forward.

The main drawbacks to the Whippet were its cramped interior and its hot running temperature, which was even worse than in the heavy tanks. If a Whippet was to run with the hatches closed for more than an hour, the machine gun rounds often swelled, jamming the guns and occasionally even exploding them. There were times when they became difficult to steer, thanks to the metal steering wheel having grown too hot to touch. To make matters worse, the exhaust was sent out through the side ahead of the crew compartment, which meant that when the Whippet moved forward, the exhaust wafted back into the tank, obscuring the driver's view and filtering inside. There are several reports of crews having fallen ill from carbon monoxide poisoning.

The Whippet's baptism by fire came on March 26, 1918, when a dozen of the light tanks drove into the village of Colincamps, suddenly coming upon two German infantry battalions. Despite having driven 16 hours to get to the battle,

the Whippets hadn't had any mechanical problems and they hurried into the fight, breaking up the German formation and pursuing the fleeing troops for some distance, killing many and taking a number of prisoners.

The Whippet proved itself in several similar engagements, but it was unable to attack well-defended German positions since it was unable to cross wide trenches. In these situations, they attacked the thinly held German front lines, taking out machine gun nests to aid the advancing infantry. The Whippet truly came into its own in the final months of the war when the Hindenburg Line had been broken and the war became one of movement once more.

French Tanks

While the British had been the first to create tanks, the French were not far behind, having created the Charron, the first armored car in the world, in 1902. The initial model had 3 mm (0.12”) armor all around but was open at the top. Mounted inside was a Hotchkiss M1902 machine gun with limited traverse and elevation. Several models followed. The 1904 model saw service in French Morocco.

The Charron

The French collaborated with the Russians, who had gained valuable field experience during the Russo-Japanese War. In 1905, Georgian engineer M.A. Nakashidze designed the first true armored car. Built in 1906, it had a turret for the machine gun and a completely enclosed superstructure. This was the model upon which most later armored car designs from all nations were based.

The Nakashidze-Charron measured 4.8×1.70×2.4 m (15.75×5.58×7.87 ft), weighed of three tons, had a crew of three or four, a top road speed of 45 kph (28 mph) and a road range of around 100 km (62 miles). Armor varied depending on the unit, ranging from 4 to 8 mm (0.16 to 0.32 in). Despite their

early inception, several Nakashidze-Charrons saw service in the opening battles of World War I.

A far more popular design was the 1914 Peugeot armored car. Peugeot, in fact, had produced several different models that year using various chassis from their tourism vehicles, which were designed for better off-road capability. About 270 were built in all, the most popular being the Peugeot model 1914 AC ("autocannon") with a Schneider 37 mm (1.45 in), short-barrel, model 1897 gun mounted on a pivot. More than 150 were produced but the gunner was somewhat exposed in the open-top arrangement.

The next model, the Peugeot AM ("automitrailleuse", meaning "machine gun"), carried a model 1914 Hotchkiss 6.5 mm (0.25 in) machine gun within a proper, fully encased turret. About 120 of these were made and brought quickly to the front at the start of the war where they saw their first action in August of 1914.

Both models measured 4.80×1.80×2.8 m (15.75×5.9×9.18 ft) and weighed approximately five tons, with armor up to 5.5 mm (0.21") thick. They carried a crew of four or five (driver, commander, one or two gunners, and a loader), had a road speed of 40 kph (25 mph), and a road range of 140 km (85 miles), but like many early armored cars, they did not perform well off-road. They served better in the more mobile fighting in the opening weeks of the war, and again in its final weeks.

Several other models followed from various manufacturers, and they were attached to the cavalry wing for fire support. All of these armored cars tended to bog down in rough and muddy terrain, however, and were thus unsuitable for the static conditions of the Western Front during the majority of the war.

Early in the war, a few wire-cutting and remote-controlled explosive vehicles were tried, but none proved capable of facing real battlefield conditions. The first attempt at a true French tank came in 1914, when M.M. Schneider & Cie bought some American Baby Holt 45 horsepower caterpillar tractors. These and similar tractor models were already used by several armies for towing artillery, but the company envisioned arming and armoring them. During a display in November of 1915, they caught the eye of Colonel Swinton's French counterpart, Colonel Jean Baptiste Eugène Estienne, an early

proponent of many innovative military ideas. Described as having a "fervid imagination tempered by common sense," he was a man who was taken seriously by the high command. He had already played a key role in introducing the idea of using aircraft for artillery spotting.

Colonel Estienne took the company's tractor and, with his fervid imagination, created a tank. His initial plans called for a four-man crew, an armament of two machine guns, and a 37 mm cannon. The tank would be able to cross trenches, plough through barbed wire entanglements, and be immune to small arms fire. It would also tow a bulletproof trailer carrying 20 soldiers, there to exploit the breach in the enemy front line.

Colonel Estienne quickly gained lukewarm support for pursuing his idea and went at it with considerable energy, contacting the Schneider Company and getting to work. Together, they completed a preliminary design before the end of the year. On February 25, 1916, the French government signed a contract with Schneider for 400 *Tracteurs Estienne,* a codename used to hide their real purpose; the official name was the Schneider CA (*char d'assaut*).

The Schneider I tank

While the series was supposed to have been delivered in full by November of that year, the first prototype wasn't completed until March. The final design

was a longer version of the Holt suspension, fully armored with a rectangular superstructure and a nose shaped like a ship's bow. It was hoped that when faced with an overly-wide trench, the tank would tip into it, jam its bow against the far side, and the power of the engine would push it up and over, but this behavior wasn't reliable. A metal tail in the rear designed to lengthen the vehicle was also intended to help with the crossing of trenches.

The tank was armed with two Hotchkiss 8 mm machine guns, one on each side, and on the right side, a Schneider 75 mm short cannon in a ball mount. There was no frontal armament because the bow-shaped front got in the way. The bow was also fitted with a wire cutter, and the crew number was upped from four to six. The tank measured 6.32 m×2.30 m×2.05 m (20 ft 9 in×7 ft 6 in×6ft 9in) and weighed 13.6 tons. It had a speed of 8 kph (5 mph) and a range of 80 km (50 miles) on the road and 30 km (19 miles) off-road.

Work proceeded slowly, and by the deadline, only eight were ready for service. Production was delayed throughout 1917 due to the French High Command's demand that the company give precedence to making standard tractors for towing artillery. Another blow came when the British used their tanks at the Somme. The French had repeatedly asked the British not to use their tanks before the French ones were ready, preferring to use the British and French tanks in tandem to maximize shock value. It was a sentiment with which many British commanders agreed. In his memoirs, Prime Minister Lloyd George complained that the tanks' "great secret was sold for a battered ruin of a little hamlet on the Somme not worth capturing."

The French feared that the game was up and that the Germans would put smaller field guns on the front line to take out Allied tanks and widen trenches to prevent the tanks from crossing. The Battle of the Somme also led the Schneider Company to modify the design of their tank. Fearing German field guns and the more powerful armor-piercing machine gun rounds the Germans had deployed, the company supplemented the 11.5 mm (.45") armor with a front plate of 8 mm (.31"), placed 20-40 mm in front of the regular armor to reduce the impact from any hits.

Finally, in the spring of 1917, some of the first Schneider CAs were ready for deployment. Made a wing of the artillery, they were organized into tactical units— called a *groupe*—consisting of four tanks, four support batteries, and a

workshop. They saw their first combat during the Nivelle Offensive on the Chemin-des-Dames on April 16, 1917. Though they knew little to nothing of the French preparations, the Germans already feared the British tank and had taken countermeasures, such as widening frontline trenches. Thus, the tanks, initially supposed to be at the forefront of the attack, were relegated to fire support where they would wait for the initial infantry assault to take the frontline trenches before moving forward, accompanied by pioneer units to help them cross troublesome barriers. Part of the offensive was along the River Aisne, which, with its high ground to the east occupied by the Germans, had seen the first trench warfare of World War I in September of 1914. The front in this sector had not significantly changed since then, nor was it about to.

A total of 132 Schneider CAs went out that day, but they were soon spotted by German airplanes which soon directed artillery fire against them. To make matters worse, the infantry failed to take many of the initial objectives and the tanks couldn't make it through except in one spot, where some of the tanks had been able to penetrate 5 km (3 miles) behind German lines. While the breakthrough made good newspaper copy, it made little difference to the battle because the tanks lacked infantry support and were thus forced to quickly withdraw.

The tanks suffered heavy losses. German artillery knocked out 57 of them, and 13 more broke down or were stuck in the muddy and irregular terrain. Some 180 crewmen were killed or injured. These were but a drop in the bloody ocean of that failed offensive, as about 40,000 Frenchmen out of more than 187,000 lost their lives for little gain in the first day alone. Coming so soon after the disaster at Verdun, the offensive was the major cause of widespread mutiny the following month, when soldiers swore that while they would continue to defend the nation, they would no longer participate in pointless offensives.

While the high command and the regular troops argued over how to conduct the war, engineers at Schneider learned some lessons from the failed battle. Most of the German hits had been against the front of the tanks, where they had foolishly put the twin fuel tanks, thinking they would be safe behind the armor. As it turned out, even the slightest breach of the armor could turn the interior of the tank into an inferno, so they moved the fuel tanks to the back. Moreover,

German machine gunners had been quick to spot the tank's viewing slits and focus their fire on them. Even near misses could prove troublesome, shearing off shards of metal that could injure or blind the crew. To remedy this, the company painted a dark crosshatch pattern on the tanks to obscure the slits from view.

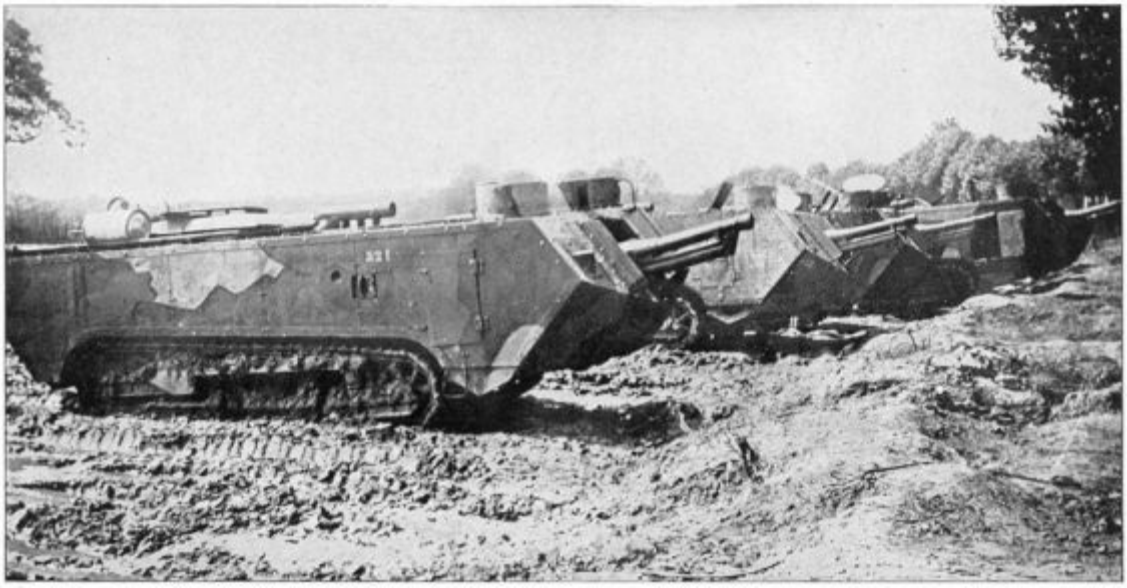
The shearing effect proved a problem in all tank models, because even when bullets hit a blank armor face, they sometimes knocked off shards of metal, called “spall,” from the interior face, which flew around the cabin. Crewmen had to take to wearing goggles and metal masks or chainmail face guards, causing them to look strangely medieval while operating one of the most advanced weapons in the most modern of wars.

While the Schneider was being tested and deployed, another branch of service, the *Direction du Service Automobile*, decided to create its own tank. Believing bigger was better, they used an elongated Holt chassis to carry a long 75 mm Saint-Chamond rapid fire field gun and four Hotchkiss machine guns, which would provide more firepower than the Schneider.

A contract for 400 such tanks was awarded to the FAMH steelworks in Saint-Chamond, a town which would give its name to the new vehicle. Oddly, it was electric instead of diesel, using its own 52 kilowatt generator to power a separate electric motor on the drive sprocket on either side of the tank, making it easier to steer than the Schneider but driving up costs.

Like the Schneider, it had a rectangular superstructure and a bow-shaped front. The Saint-Chamond’s bow was fitted with rollers to help it get out of wide trenches. It measured 8.9 m×2.70 m×2.40 m (29 ft 2 in×8 ft 10 in×7ft 10in) and weighed 23 tons. Inside was enough room for a crew of nine. The tank was able to go at 12 kph (8 mph), had a road range of 60 km (37 miles), and an off-road range of 30 km (18.6 miles). Its armor varied between 11-19 mm (0.43-0.75”).

Many of the tanks were modified during production, fitted with other artillery pieces than the one intended, and some were given a cupula on top for viewing. Some had flat roofs while others were sloped, designed to deflect grenades. The variations were numerous and complex, and in the end, mostly irrelevant because they proved to be of little use in actual combat.



Saint-Chamond

They were finally deployed on May 5, 1917. One Saint-Chamond group (three batteries of four tanks each) and two Schneider groups attacked the German position near Laffaux Mill. The Saint-Chamonds suffered a number of breakdowns but they and the Schneiders helped the infantry advance by taking out several German machine gun nests. By the end of the day, three Saint-Chamonds and three Schneiders had been lost.

10 days later, on May 15, Nivelle was replaced as commander in chief by General Phillippe Pétain. Rejecting the mindless frontal assaults that had wasted men and caused mutiny, Pétain understood the need for more caution and greater firepower, appreciating the benefit of tanks as morale boosters. Pétain instituted drills between infantry units and tanks to refine tactics before launching his first major offensive around Malmaison on October 23, 1917.

A portrait of Pétain

On that day, 56 Saint-Chamonds and 36 Schneiders moved out with the infantry in a coordinated assault. Though foggy conditions screened their advance, the French lost only two tanks. The offensive made only modest gains, but they proved to the French that under the right conditions, tanks had value. High command ordered intensified infantry-tank training and introduced

another innovation, fitting tanks with radios to communicate with each other and with headquarters.

Meanwhile, Colonel Estienne was busy with a new idea. The initial run of 400 Schneider tanks wasn't completed until 1918, and he saw how the French industry had been strained to the limit from the demands of war and was not up to the task of producing enough of the large tanks to overwhelm enemy defenses. As early as July of 1916, the colonel discussed the issue with automobile manufacturer Louis Renault. Estienne envisioned a group of small, lightly armored vehicles able to move quickly, break through barbed wire, and use a single machine gun to suppress enemy fire.

After a demonstration of a mockup on December 30, 1916 before the Consultative Committee of the Assault Artillery, Renault was awarded a contract for the production of the first 100 *chars mitrailluers*, which would become the famous Renault FT, the "FT" being a product designation given by the factory, and despite various theories in secondary sources, does not actually stand for anything. The light tank performed well in official trials in April of 1917, showing such promise, the government ordered another thousand before the official trials had even been conducted.

The basic Renault FT model was armed with a single, Hotchkiss 8 mm Model 1914 machine gun. It had a crew of two (commander/gunner and driver), weighed 6.7 tons, and measured 5 m (16'5") ×1.74 m (5'7") ×2.14 m (7'). The hull had 16 mm (.63") armor on the front and 8 mm (.31") on the sides, while the turret had riveted 16 mm armor or a stronger cast turret of 22 mm (.87"). It had a maximum speed of 7.5 kph (4.8 mph) and a range of 35 km (25 miles). It was able to cross trenches 1.8 meters (6 ft.) wide and a vertical obstacle .65 meters (2 ft.) high.

The Renault FT

Two variants were introduced: the *char canon*, which replaced the machine gun with a 37 mm gun, and the *char signal*, which had a boxier, fixed turret holding a wireless set. This latter model was deemed a failure by the men because the wireless set often broke down and the antennae were prone to damage. The *char canon* was soon the favored model and would remain in French service throughout the interwar period. In fact, it would see service in several conflicts, including during the Spanish Civil War (1936-39), and they were even deployed against invading Panzers during World War II, albeit not to a great effect.

The Renault FT was a true innovation. Rather than a few ponderous tanks smashing their way through isolated points, Colonel Estienne envisioned a "bee swarm" of lighter tanks across a broad front. This would allow for more flexibility in tactics and maneuverability, and the loss of one or two individual tanks as a result of breakdowns or enemy fire would not spell disaster. Estienne reasoned it was impractical to make a tank strong enough to resist

German field guns, and it was better to have a larger number of smaller, faster tanks that would be harder to hit.

The initial idea was to have the Renault FTs work side-by-side with the heavy tanks at a ratio of five to one, but by the spring of 1917, the limitations of the larger tanks had become evident, and Pétain increased the order of FTs to 3,500. Now, the Renaults would operate mostly on their own. To mollify his dispirited troops and to stave off the danger of another mutiny, he promised there would be no major offensives until the spring of 1918, when the tanks would be ready and they could rely on an influx of American manpower. Plans for the tanks were sent to American and Italian factories to speed up production and supply those respective armies with their own tanks. Renault also permitted competing French factories to produce the design, and by October of 1918, there were orders for 7,820 tanks in France alone.

With the number of Renaults quickly outstripping those of heavy tanks, the Renaults were organized into separate battalions, made up of three companies. A battalion had 30 gun tanks, 41 machine gun tanks, and 4 radio tanks. This ideal, however, rarely saw application, as there was a shortage of machine gun and radio tanks and battlefield losses and breakdowns further varied the figures.

Unlike the British, who had wasted the element of surprise by sending in a few tanks as soon as they had them, General Pétain decided to amass several hundred light tanks and launch them on a spring offensive, slated for May 1, 1918. Instead, he was preempted by the German Ludendorff Offensive of March 21. The first unit of Renault FTs went into action 10 days later, and some 200 tanks were broken up into groups of 30 to support infantry counterattacks.

The first fight was alongside Moroccan troops around Ploissy-Chazelle and the Renault FTs performed well in this and all other engagements. On open ground, they were quickly able to overrun German forward positions, while in the forested sectors, they were able to drive down narrow paths that would have been impassable by the larger British and French designs. There were not enough of them, however, and within a few weeks, many Renault FTs had stopped working due to breakdown.

In the meantime, the heavy tanks continued to see service. On June 11, 51 Schneider and 96 Saint-Chamond tanks advanced in the Metz Valley to help stop a German offensive on one of the approaches to Paris. This they did, but not without losing half their number.

An even larger offensive came on July 18, 1918 near Soissons, when 100 Saint-Chamonds and 123 Schneiders moved forward with 255 Renaults in the vanguard. The tanks, especially the Renaults, performed well, often having to stop because the infantry had lagged behind, and were unable to consolidate their gains. Tanks, not men, had become the main impetus for an assault.

The Renault FT was now the favored tank, and even more were ordered by enthusiastic armed forces. The heavy tanks had suffered serious losses and the numbers had not been replaced as production had been stopped for all but the Renaults. Its production proceeded apace, with a new battalion appearing almost every week.

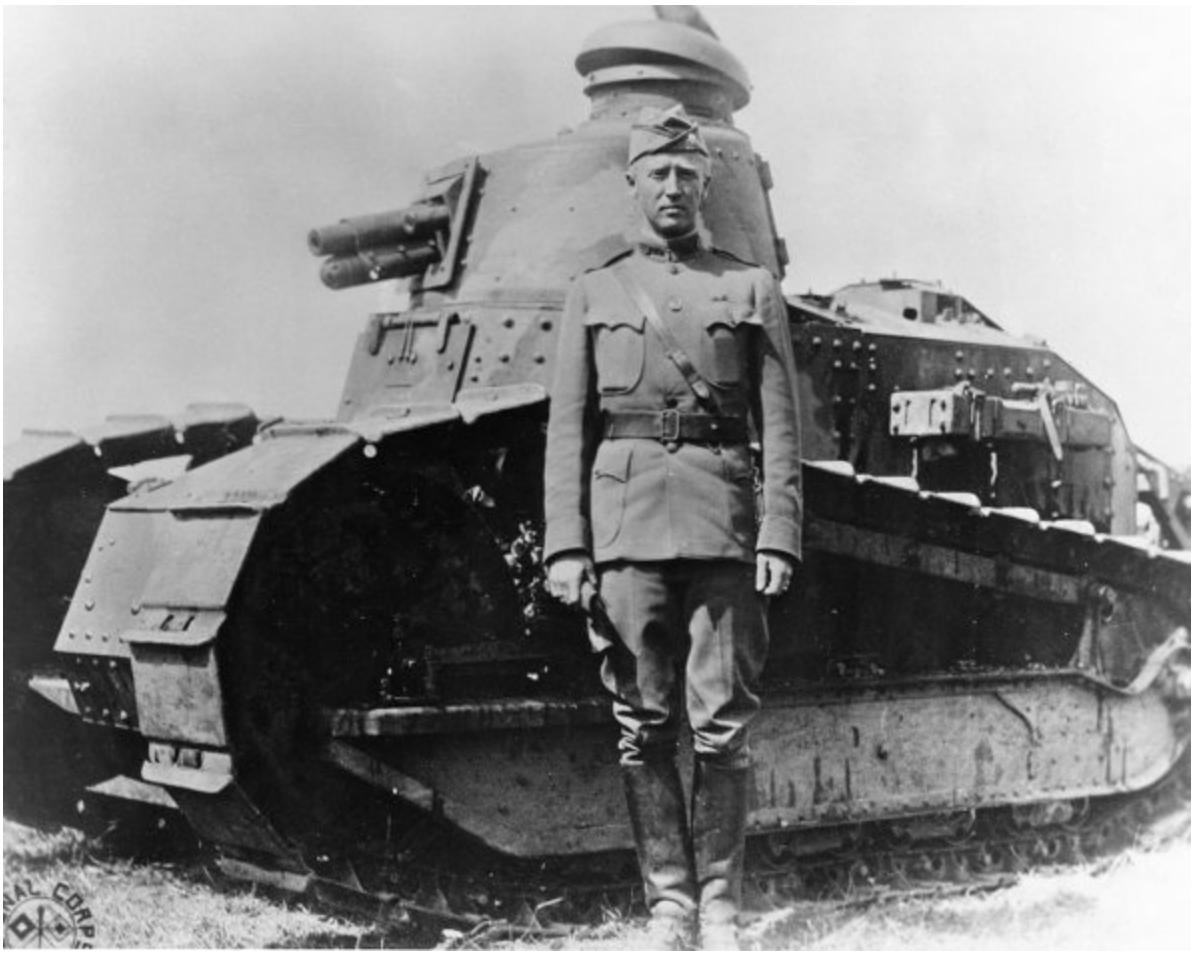
At the same time, the Renault FT was not without its problems. It was only able to run for a few days in combat conditions before requiring a complete mechanical overhaul. Also, its small size and light armor made it vulnerable to mines, artillery shells, and flamethrowers. Moreover, the army never found enough time to train the infantry to work in cooperation with the tanks, as the Renaults had to be fed into the grinder of the Western Front as soon as they came off the assembly line and would be kept hidden from the German Air Force until the time came to send them into combat, making practice maneuvers with the troops impractical.

By the summer of 1918, the Germans had implemented a number of countermeasures against the “bee swarm” of light tanks. Their machine gun nests were vulnerable to the Renaults, so they began putting them in concrete pillboxes that were able to withstand machine gun fire from tanks. This forced French crews to drive right up to them and fire through the gun slit, taking steady machine gun fire to their own gun slits all the while. The war became one of nerves and marksmanship, often lost by French tank crews.

The pillboxes were a partial countermeasure that could always be circumvented, and later flanked and neutralized, by the infantry. The Germans had some success taking out the light tanks with artillery and mines, but the

large number of Renault FTs meant the losses were easily replaced. Wide, anti-tank trenches temporarily disabled some tanks, but the Germans never came up with a truly effective protection against the French “bee swarm” of light tanks.

Light tanks were used in increasing numbers throughout the final year of the war, by both the French and the newly arrived American troops. The U.S. was supposed to design its own light tank, but they had yet to come off the production line, so American units were provided with Renault FTs, manufactured either in France or the United States. They also received some Mark IVs and Vs. The first commander of the American tank battalions was Lt. Col. George S. Patton, using battalions that had been trained in the United States at a training center commanded by Lt. Col. Dwight D. Eisenhower. Renault FTs—from both American and French and American battalions working in cooperation—played a role in every American offensive, including the American Expeditionary Force’s baptism by fire at Saint-Mihiel on September 12, 1918 and the Meuse-Argonne Offensive starting later that month.



Patton standing in front of a Renault FT tank

Italy had originally planned to produce Renault FTs, but the Italians were unable to get the program started before war's end. Instead, that nation used the pioneering French light tank as inspiration for its Fiat 3000, an interwar model.

The Austin Armored Car

While the main focus of this book is tanks, any history of early armored vehicles would be remiss in omitting the Austin Armored Car, the most successful armored car design of the war and one which would be used for decades thereafter.

In 1914, a Russian committee came to England looking for an armored car suitable for their needs and signed a contract with the Austin Motor Company for 48 armored cars. Known as the Austin 1st Series, these vehicles used the Austin "Colonial" chassis, specifically built for rough roads, with a high clearance, rear axle drive, spoked wheels, and 30 horsepower engine. The tires were special, rubberine-filled, self-sealing models, making them relatively immune to puncturing.

The model was unusual in that the Russians wanted at least two machine guns, and thus the designers fitted two turrets, each provided with a Maxim machine gun, which sat side-by-side behind the driver, covering 180 degrees each. They were also able to combine their fire to the front and the rear. The crew included a driver, two gunners, and a commander. There were doors on the left side and rear. Weighing in at 2.66 tons, it could go up to 60 kilometers per hour (37mph) on roads, with a range of up to 250 km (155 miles). The vehicles were purchased for £1,150 each, a considerable sum.

The Austin works provided the cars with 3.54 mm (0.14 in) armor, but the Russians replaced this with thicker, 7 mm (0.28 in) plates when they arrived in Russia. With the reduced speed and maneuverability, they performed well in action, and the Russian government soon asked for a second, improved series in March of 1915, resulting in the Austin Series II, which used a stronger, truck chassis driven by a 50 horsepower engine. It was bigger than the first series, measuring 16 ft×6.8 ft×9.4 ft (4.90×2.03×2.84 m). While it was considerably heavier than the Austin I at 5.3 tons, it could still go up to 60 kph (37 mph) on roads and had a range of 200 km (124 miles). Among various minor adjustments, the rear doors were eliminated in order to strengthen protection to the rear armor. Like the first series, it had a crew of four. Sixty Series IIs were made for the Russian government. Once they arrived in the tsar's domain, Russian engineers added modifications of their own, including extra armor for

the turrets and a rear driving post.

Once again, the Russians were happy with their purchase, and they ordered the Austin Series III in August of 1916. This model followed Russian modifications, including a rear driving post. It also had bulletproof glass on front-vision slits and eliminated vision slits on the sides. For weight, speed, and range, it was the same as the Austin Series II.

A Pattern 1918, with double rear wheels for extra traction and a Hotchkiss machine gun was ordered but never delivered, due to the political turmoil of the Russian Revolution. Instead, they were purchased by the British Army, which used many Austins throughout the Great War and interwar period, especially in the colonies. They served with distinction on two occasions on the Western Front as part of the 17th (Armoured Car) Battalion of the British Tank Corps. The first occasion was during the Battle of Amiens (August 8-11, 1918), when the Austins penetrated 10 miles (16 km) behind German lines, swept aside various reserve units, and captured a headquarters. The 17th had the distinction of being the first unit to cross the Rhine at war's end.

The Russians used Austins extensively, forming them into two types of units: lead platoons were equipped with three Austins, four staff cars, three support trucks (including a motor workshop and tanker), and four motorcycles. In addition, 46 soldiers were assigned to the platoon for guard duty and to hold any positions taken.

The more common "regular" platoon was supplied with two Austin armored cars and a Garford-Putilov armored car (see the "Other Nations" section for more information about this vehicle). There was also a staff car for the commander, a truck for supplies, and a motorcycle for scouting. Two to five platoons formed a battalion and were attached to specific armies. The Russians also purchased a number of Austin II chassis and used them to produce their own model, called the Austin-Putilov by historians, but the Russian Civil War intervened and they were never used in World War I.

The Austin armored car and its local variant saw extensive use by both sides in the Russian Civil War, in the war between Russia and Poland in 1920, and were purchased by several other nations, including Mongolia. It was by far the most successful armored car design of the Great War and remained in use in

many parts of the world until the start of World War Two.

The German Response

By the start of 1917, tanks had suffered a number of failures and only a limited amount of minor successes. Nevertheless, British and French planners continued to work on the design and deployment, and their persistence finally paid off, although not without further disappointments.

A poor application of tank technology came during the Third Battle of Ypres (popularly known as “Passchendaele”), in July of 1917. The swampy conditions resulting from years of bombardment and heavy rains made it all but impossible for infantry to move forward, let alone armored vehicles weighing several tons. Conditions were not improved by a massive artillery barrage of 3,091 guns along an 11 mile front for 15 days. The Tank Corps had 216 tanks at the scene, mostly Mark IVs, and they got stuck in the mud as much as the men did. More than 70 tanks were bogged down on the first day alone and picked off at leisure by German artillery. Often, a man would have to walk ahead of a tank to test the ground while in full view of the enemy.

A disabled tank on the battlefield

In the middle and late months of 1917, tanks saw limited action up and down the line. Once over their surprise and shock, German troops did not hold tanks in terribly high esteem—half the time the lumbering brutes were unable to make it to their lines, and when they did, their fire was inaccurate. They could also be taken out with field guns and the occasional grenade or armor piercing round.

The watershed moment for tanks came at the Battle of Cambrai on November 20, 1917, when 474 British Tank Corps tanks, mostly Mark IVs, broke through 12 miles of the German front line, taking 10,000 prisoners, 123 artillery pieces, and 281 machine guns. The ground had been chosen well—a stretch of dry and relatively flat terrain between the Canal du Nord and the St. Quentin Canal. The attack was not preceded by the usual artillery barrage to maintain secrecy and so the ground would not be chewed up further than it already was. The tanks were supported by 1,000 guns, which gave supporting fire once the

tanks had gotten underway, as well as six infantry and two cavalry divisions and 14 squadrons of the Royal Flying Corps.

The Germans were pushed out of the first three trench lines on their Hindenburg Line for the first time. Sadly for the Allies, this success was not followed through, as there was an insufficient number of infantry to hold the newly conquered ground from fierce German counterattacks and most of the gains were soon lost. Several British tanks fell into German hands, only to be studied and reused. The Allies lost 45,000 men and the Germans 50,000—men the Germans could ill afford to lose—an unusually even ratio for attackers and defenders in a war typified by defensive superiority. Germany had already been bled dry of troops, and the withdrawal to the Hindenburg Line had specifically been carried out with the aim of conserving lives.

A picture of German soldiers taking a Mark IV tank at the battle

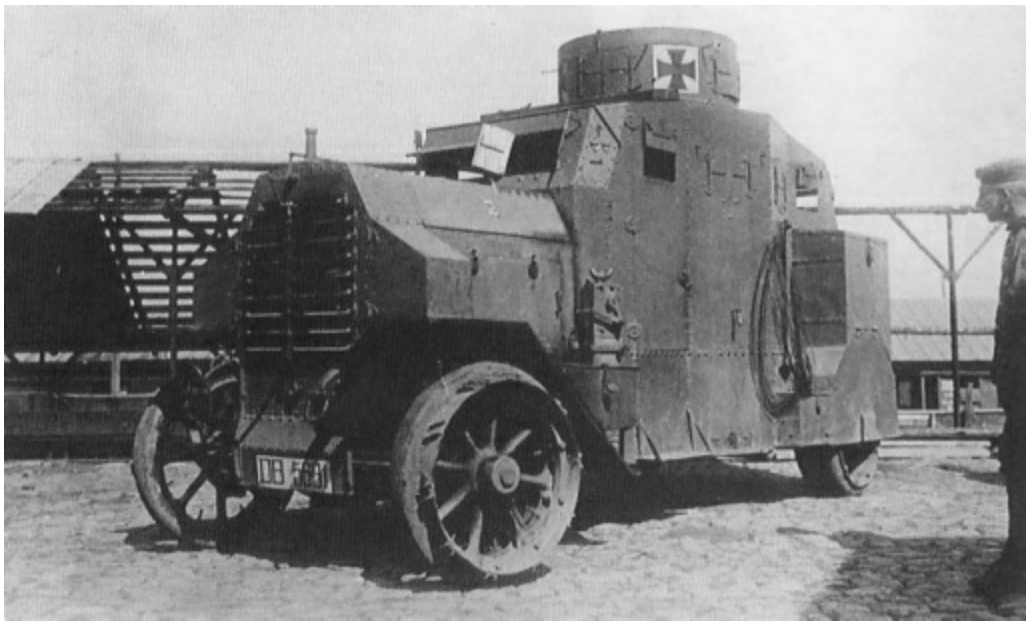
The resounding success of the tanks at Cambrai made everyone take notice. The Germans, whose tank efforts had been all but nonexistent up to that point, finally decided to get into the tank production game.

For such a heavily industrialized nation, Germany was slow to start the

development of armored vehicles. This was partially due to attitudes of the German High Command and partially due to economic realities. The idea of war in the minds of its German planners was that of quick and decisive attacks. German military planners weren't interested in armored cars because they were limited to roads, and any grand invasion of France or Russia—considered the major enemies of the day—would involve much overland marching. Once the war had bogged down, tanks were considered slow and cumbersome and thus incapable of making the swift breakthrough the German generals dreamed of achieving, and rightly so. Then, when the Germans shifted to a more defensive mode, tanks were seen as unimportant, since they didn't fit into a fixed defensive strategy.

To make matters worse, Germany's industry was slowly being strangled by the Allied blockade. Starved of raw materials and barely able to keep up with the demand for more conventional weapons, Germany's industry was simply incapable of making the shift to producing tanks.

When German troops came up against Allied armored cars in the opening campaigns of 1914, the generals quickly changed their minds about the need for such vehicles. Delays in production and the fact tanks were considered low-priority meant that only one model, the Ehrhardt E-V/4, ever saw mass production, and even then, only a few dozen were produced. Most of them were sent to the Eastern Front to serve in occupied areas against local resistance. The Ehrhardt E-V/4 was a standard design for armored cars of the era, being a simple, heavy-duty car chassis fitted with plate armor, a turret, and openings for one or more machine guns. The armor was up to 9 mm (.35") thick, carried a crew of nine—making it quite cramped, and the numerous ports could hold up to four machine guns. The armored car went through three models. Later units included a radio. It was a hulking vehicle, measuring 5.3×2×2.85 m (17.3×6.5×9.35 ft) and weighing slightly more than seven tons, which meant it had trouble going off-road and proved easy to hit. It had a maximum road speed of 61.3 kph (38 mph) and a road range of 250 km (160 miles).



The Ehrhardt E-V/4

The Germans also made use of a large number of captured Russian armored cars which, along with the Ehrhardt models, saw extensive service with German police in the quelling of social uprisings in the interwar period.

The story was similar when it came to tanks. After experiencing the first tank attacks from their British adversaries, the Germans called for tank designs from industrial firms in late October of 1916, but the firms showed little interest because they had already begun to feel the pinch from the Allied blockade, and their factories were stretched to the limit while producing more standard arms. Nevertheless, a committee was established to produce the Abteilung A7V, named after the Abteilung 7 Verkehrswesen, the 7th Transport Division. The A7V, as their product was called, would be the only German tank model to see combat.

The contract was awarded to the Daimler firm, which used a Caterpiller-Holt tractor base, and the government ordered 100 units before field tests had been carried out. This optimistic order was not backed with enthusiastic support, the program was never a priority, it didn't receive sufficient resources, and thus, the program moved slowly in the year 1917. The order was scaled back to 10 tanks, and the High Command also changed the design, calling for it to be armored enough to deflect field gun shells, having noted the British Mark series could be taken out with a well-placed shell and fearing the

same fate for the A7V. The new requirements necessitated an entire redesign, causing further delays. In the end, it was impossible to put shell-proof armor on all sides, so it was only put on the front, making the A7V nose-heavy, a fatal flaw when trying to pass through the mud of the Western Front.

An A7V during the war

The A7V finally got some belated support after the Battle of Cambrai in November, when the Germans saw just how effective tanks could be when deployed in large numbers. The order of A7Vs was raised to 40, and they were supposed to be ready by February 1918, in anticipation of a spring offensive.

Another result of the fighting at Cambrai was that the Germans captured about 100 tanks during the German counterattack, which took back almost all the British gains. While most of the tanks were damaged, many of them could be fixed, and those that couldn't were cannibalized for spare parts. Germany was also getting a small but steady supply of British and French tanks from other sectors. In the end, the German army used more captured Allied tanks than their own vehicles.

Only 22 A7Vs were ever produced, one of which was a prototype later used for training, and another was found to be flawed and was broken up for parts after trials in late 1918. The other 20, however, did see combat. The final design was behemoth—a blocky, nose-heavy vehicle, poorly suited to the task. It was 24'1"×10'×10'11" (7.35 m×3.06 m×3.35 m). Standing at over 10 feet, it had a ridiculously high profile and offered an easy target for field gun crews. It also had a clearance of only eight inches (.2 m), so despite its tracks, it could be easily caught on obstacles and other obstructions in rough terrain. It weighed 33 tons, had a maximum speed of 10 mph (16 kph), and a range of 22 miles (35 km) overland and 43 miles (70km) on roads. Its bow-shaped nose, copied from French heavy tank designs, helped it cross trenches 6'6" (2 m) wide.

Its poor speed and maneuverability was supposed to be made up for by its thick armor and heavy armament. Its bow armor was 1.18" (30 mm) thick, the sides and rear were .59" (15 mm), and the roof was .23" (6 mm). In the front, it had an effective 57 mm Maxim-Nordfeldt Model 1888 Quick Firing Gun, capable of firing up to 25 rounds a minute. The gun was supplied with 50 high explosive, 30 armor piercing, and 20 grapeshot rounds. The A7V also had six 7.9 mm Model 1908 Maschinengewehr machine guns.

The German High Command was not terribly satisfied with their lone tank model, which proved unsuitable for the conditions of the Western Front. Wide trenches, or even shell craters, could stop it, and British tanks and French light tanks could outmaneuver it. The only Allied tanks it could outperform were the French heavy tanks. On March 3, 1918, the German high command ordered the final 80 chassis ordered be used for transport vehicles, rather than be turned into tanks. Thus, the German tank project was stopped before it was ever given a proper chance to succeed.

The remaining A7Vs did, however, see combat. Four went into battle alongside an elite Sturmbataillon ahead of the 36th Infantry Division in the St. Quentin area on March 21, 1918. There was a heavy fog that morning and two tanks were trapped in barbed wire. The attack was delayed while the tanks were freed and until conditions improved. Only one managed to get going again, and of the three that moved forward in the renewed assault, one broke down.

The two remaining tanks, however, dispirited the British troops, who withdrew from their positions. These A7Vs fought alongside the German infantry for the rest of the day, proving quite useful, as did a sister company of five captured Mark IV females, two of which had been knocked out.

After this somewhat promising start, the A7Vs were assigned to various sectors. They proved useless around the Lys River, where nearly all of them bogged down in an assault across wet terrain.

The largest German tank assault of the war took place around the town of Villers-Bretonneux on April 24, 1918 and involved 13 A7Vs. The tanks helped capture the town in the early morning and staved off a British counterattack at noon. To the south on that same day, one A7V—dubbed "Nixe" by its crew—became a key player in history's first tank versus tank battle. As it approached the hamlet of Cachy, it came under fire from three British Mark IVs—a male and two females—which the German crew didn't initially notice due to the noise of their own engine. When they finally did, they turned their 57 mm gun on the male tank. After a few shots, the male Mark IV stopped, the Germans assumed they had knocked it out, and they turned on the two female tanks, quickly disabling them.

In fact, the male Mark IV was not out for the count—its commander had ordered the tank to halt so the gunners could get a better shot, as the Mark IV model shook so much when it moved that the gunner's sighting telescope was useless. As such, stopping was the only way to ensure an accurate shot. The British gunner landed a shell in a direct hit on the bow of the A7V near the gun, killing the German gunner and wounding five others. The survivors scrambled out, thinking the ammunition was about to explode, and the Mark IV fired two more shots into the side and moved off. The German crew hovered about for a time, and when they saw their tank was not about to burst into flames, they got back in and drove it toward their own lines. They made it a little over a mile before grinding to a halt as one of the hits had caused an oil leak. The vehicle was later retrieved and repaired.

Later that same day, history's second tank versus tank battle occurred. A British counterattack supported by seven Whippets and the same male Mark IV that had tangled with Nixe attacked the 77th German Reserve Division, overrunning the forward positions only to come under fire from a field gun

battery and an A7V. In the ensuing fight, the Mark IV and four Whippets were taken out of commission.

This was the high point for the A7V. While used throughout the German summer offensive of 1918, they were never as useful as the captured British tanks. Overall, German tank numbers were so low that they made little difference in the war effort.

As spring turned into summer, another problem arose for the German tanks. While all early tanks had been hot inside, the A7V was especially so. Its heavy duty, twin engines were located inside the cab and radiated heat so that the interior temperature could rise as high as 140 degrees Fahrenheit (60 degrees Centigrade) in the summer. Heat exhaustion was just as dangerous as enemy fire, and the tankers had to stop frequently to leave and get some fresh air.

The failed summer offensive put the Germans on the defensive for the rest of the war. There was little use for tanks, and their numbers had already dwindled badly due to breakdown, getting stuck beyond recovery in No Man's Land, or being knocked out by enemy fire. The ever-diminishing German tank corps would play no significant role in the closing months of the war.

Other Nations

While the British and French were by far the greatest innovators in armored warfare during World War I, other nations had developed their own vehicles as well.

Belgium saw the first battles of the war when the Germans tried to sweep through the little nation on their way to Paris. Belgium had a strong industrial base and a good road system, and was thus primed for armored combat. As early as 1912, the Belgian army had pioneered the use of small groups of patrol cars with mounted machine guns.

When the war started, the government immediately ordered a series of armored cars. Called the Minerva, these featured 4 mm (0.15”) armor plates, but no roof. The crew thus had to climb into it from the top, giving it the nickname of “the bathtub.” Besides a crew of four (driver, commander, gunner, and loader), it could accommodate two more sharpshooters. The machine gun was an 8 mm Hotchkiss model 1090, 1912, or 1914, protected by a shield and mounted on the rear of the vehicle on a ring mount, allowing it to fire 360 degrees. It measured 4.90×1.75×2.3 m (16.1×5.9×7.6 ft) and weighed four tons, a road speed of 40 km/h (25 mph), and a road range of 150 km (90 miles). As was the case with many armored car models, it had poor off-road performance.

A Minerva

A second model dating to 1916 featured a more standard closed top and turret. Little is known about this model, but some may have been mounted with a gun instead of a machine gun. Both models were used in three-car groups for fire support and reconnaissance.

The Italians, who came in on the side of the Allies in 1915 and fought against Austria-Hungary and Germany, had little use for such weapons because most of their front was made up of high mountains with few or no roads. Nevertheless, the Italians feared a breakthrough into the lowlands, so they perceived a need for armored cars for colonial service in the recently conquered lands of what is now Libya and thus developed a few armored vehicles.

Fiat was the dominant car and truck manufacturer in the country, already supplying Italian armed forces with much of its motorized needs, so naturally it won the bulk of contracts for experimenting with tanks and armored cars. Its first try was a prototype called the Fiat 2000, a lumbering tank much like the German A7V. With a crew of 10, it was heavily armed with a 65 mm howitzer in a turret and six machine guns in sponsons. Only two were built and sent with several imported French Renault FTs to Libya to fight Senussi tribesmen. The British had already enjoyed great success against the tribesmen with armored cars, and the Italians hoped to duplicate that success. While the FTs performed well, the Fiat 2000s were slow and cumbersome and could not close on the mounted Senussi. This convinced the Italian high command to focus on armored cars, and the Italians would not produce a heavy battle tank before the middle of World War II.

A Fiat 2000

Fiat tried again in 1918 with the Fiat-Terni Tripoli, a standard-style armored car with a machine gun turret, mounted on an automobile chassis. It saw service in Libya and continued to be used in North Africa and into World War II.

Two of Fiat's competitors designed the Lancia-Ansaldo IZ, an odd variation on the standard armored car design, with a round, double-turret. The lower portion had two heavy machine guns, while a second turret, attached to the lower turret but capable of moving independently from it, was armed with another heavy machine gun, enabling it to fire in two directions at the same time. It also had a steel wire cutter running up at an angle on the front to efficiently break through barbed wire. A later model, the Lancia-Ansaldo IZM, got rid of the upper turret, as it had made the vehicle top-heavy. Like the Fiat armored car, the Lancia-Ansaldo IZM also saw use in the Second World War.

Lancia-Ansaldo IZ

Across the Alps, the Austro-Hungarians, great foes of the Italians, had lagged behind, as they were less industrialized than Italy, riven by sectarian strife, and

reeling from a series of humiliating defeats on all fronts. Their armed forces performed so badly on the battlefield that one German officer complained his nation had been "handcuffed to a corpse." The Austro-Hungarian army was underequipped, especially where artillery and motorized vehicles were concerned, and thus never in a position to become a leader in armored warfare. Moreover, Italy and Serbia—two of its three fronts—were mountainous and unsuited for armored vehicles. Only the vast Russian front seemed suitable for tank warfare, though the great distances involved also made the use of tanks counterproductive there.

The one Austro-Hungarian tank—designed by Günther Burstyn in 1911 before the start of the hostilities—never went past the development stage, though it was prescient in many ways. Designed to cross trenches at a time when the majority of military planners didn't think trench warfare would be a major factor in a modern war, the Burstyn Motorgeschütz, as it was called, was a small tank with a two-man crew and a turret armed with a light 47 mm (1.85 in) Skoda gun. It had caterpillar tracks combined with unique, articulated arms fitted with wheels and linked to the front and rear axles to lift or lower either end. The tanks could be lifted on regular terrain and put down to make the tank's footprint longer when crossing trenches. This interesting model never saw service.

While the Austro-Hungarian army did produce some armored cars, they did not put their innovations to good use. In 1904, they produced what was perhaps the world's first true armored car, the Austro-Daimler Panzerwagen. Records are sketchy, but the crew consisted of a driver and a gunner, with a hemispheric turret at the back fitted with one or two machine guns. Only a few were ever produced, and the army discontinued production after field tests.

In 1915, the Austro-Hungarians tried again with a brief series of the Junovicz P.A. 1, which was mounted on a heavy chassis and had six machine gun ports. It appears only two were ever assigned to the Italian front, and they do not seem to have seen combat.

A final model, the Romfell P.A. 2, was also deployed on the Italian front. Only one was ever produced and little is known about the model.

While Russia would become famous during World War II for its massive

production of tanks and innovations in armored warfare, during World War I, it was an industrial backwater with little capability to design and build armored vehicles. The vast nation did not even have a proper motor vehicle factory until 1908.

Nonetheless, these limits did not prevent the Russians from trying to develop tanks. In fact, by the war's end, Russia ended up producing a bewildering variety of armored cars.

Russia had an early start in 1905, when it purchased several Charron armored cars from France. Other armored cars had been devised before the war by a number of Russian inventors and officers, including a steam-powered model, but they never progressed beyond the design phase. Another failure came in 1914, when a proposal for a Russian tank, the Vezdekhod ("Go Anywhere")—a small tank with a single, central track and fully rotating turret—was rejected. It is difficult to know how it would have performed in battlefield conditions, but it did have some advantages over the ponderous early British models. Unfortunately for the Russians, it was never given a chance, having been deemed unnecessary by the Russian High Command. Later in the war, the high command realized its mistake, but by then the country had already descended into chaos and nothing could be done.

The Russians were also early innovators of half-tracks, with a French resident of St. Petersburg named Adolphe Kégresse making one as a plaything for the tsar as early as 1906. During the war, this design was improved upon and put on an Austin-Putilov chassis. The so-called Austin-Kégresse featured tires in the front and tracks in the rear with the option of placing skis on the front in the winter driving. The vehicle weighed 5.9 tons, could travel on roads at up to 25 kph (15 mph), and had a range of 100 km (60 mi). It was equipped with roller arms in front of and behind the front axle and rear tracks to help it climb over obstacles. Sources vary as to how many of them were made, but between 12 and 60 had been produced by the time of the Russian Revolution, proving especially useful in the muddy conditions of the Russian rainy season. They also saw service in the Russian Civil War and Polish-Russian War.

The Russian High Command, far more amenable to the idea of armored cars, produced about 30 different models, most of them local variations of foreign designs. A total of about 300 vehicles had been produced by war's end in

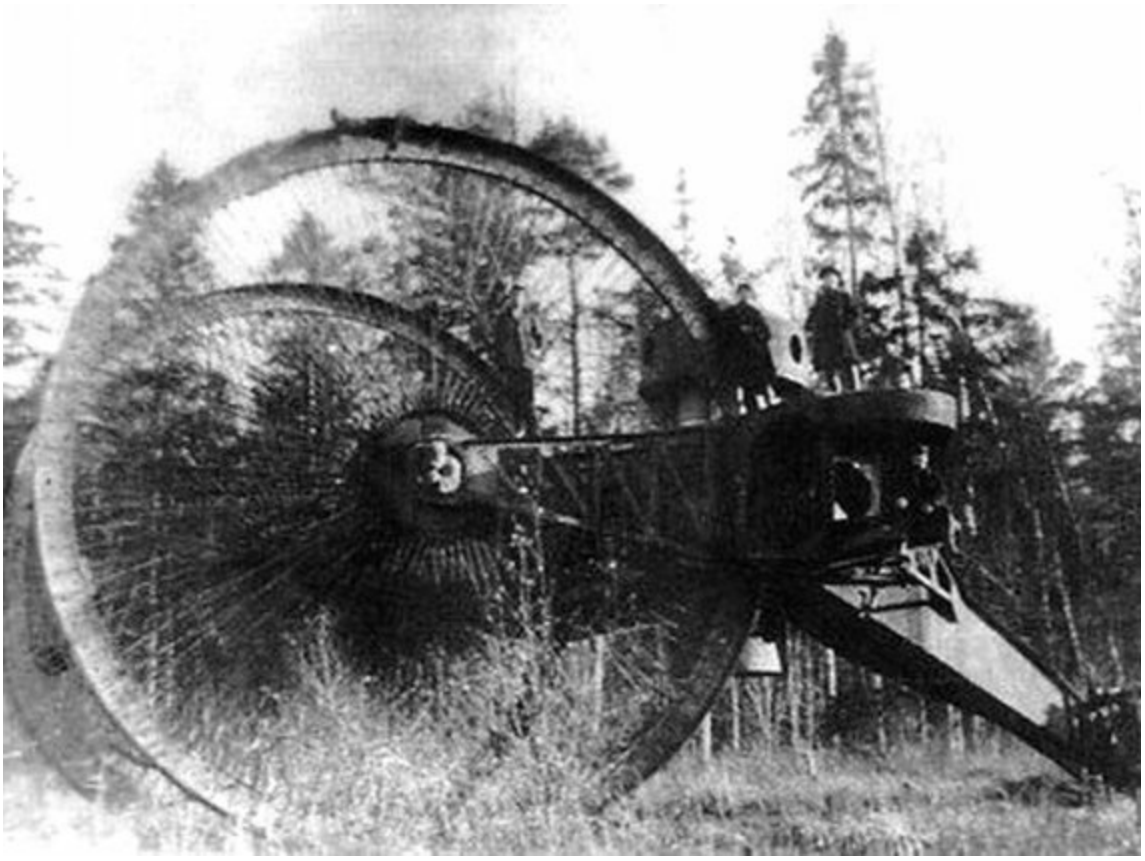
several different models, often in quantities of fewer than 10 vehicles, the most popular of which was the aforementioned Austin-Putilov. Other models came from British, Italian, and French sources, and soon there was an impressive variety. Most were simple automobile chassis fitted with a turret, although heavier models used truck chassis and sported multiple turrets, with an armament of one or more machine guns or a light artillery piece.

Russia was the only one of the minor producers of armored vehicles to develop anything approaching sophisticated tactics of use, organizing them into armored units of three vehicles, two armed with machine guns and another with a small cannon. Each unit had 100 men, mostly in supporting roles, and 21 trucks and support vehicles. Larger companies were comprised of 12 light-armored vehicles and three heavy-armored vehicles. These units and companies were attached to infantry rifle divisions, performing reconnaissance missions, as well as close fire support for the infantry.

One of the main problems with armored cars in Russia was their sheer variety, with many local models being ordered by generals from whatever factory or import company happened to be at hand, which meant there was a chronic shortage of spare parts, as well as a lack of consistency in terms of fighting capability. There was also the problem of Russia's poor roads, as paved roads were all but unknown, and frequent rains or thawing snow turned dirt roads into quagmires. This served to defeat more than one invading army, as well as the Russian armored companies, as their tires tended to sink in muddy conditions. In the winter, snow proved to be just as much of an impediment.

Alongside the development of armored cars, the Russians tried a few more tank prototypes, encouraged by the success of the British and French models on the Western Front. By far the oddest prototype was the Tsar Tank, which featured a gigantic pair of bicycle wheels 39 feet (12 meters) in diameter that were designed to roll over enemy trenches. A pair of smaller, stabilizing wheels to the rear made it look a bit like an oversized velocipede. It had a small carriage between the front wheels that would have been fitted with a light cannon and machine guns, but its high profile and dubious stability, plus a lack of armor, convinced the military its use on the battlefield could only lead to embarrassing failure. It was tested in 1914, but it got stuck in soft soil and

left where on the spot until 1923, when it was dismantled for scrap. Instead of producing their own tank, Russia decided to order some Renault FT, British Mark V, and British Whippet tanks in 1917.



The Tsar Tank

Russia also produced an armored truck, weighing in between an armored car and a tank. Called the Putilov-Garford, it was produced by the Putilov factory and used an American Garford Motor Truck Company truck chassis, with the intention for it to carry a cannon and provide a heavier support for armored cars. The Putilov-Garford carried a 76 mm mountain gun mounted on the rear truck bed and housed in a turret. The armor plating measured 6.5 mm (0.25 in) thick and was made of rolled steel sheets able to withstand all small arms fire, including armor-piercing bullets. Parts of the truck, such as the turret, had thicker armor. In addition to the gun, there were three 7.62 mm (0.3 in) Maxim M1910 machine guns, two placed in sponsons at either side of the truck's front, each of them with a firing arc of 110°, and a third machine gun positioned in the rear turret next to the gun.

The truck measured 5.7×2.3×2.8 m (18.7×7.54×8.2 ft) and weighed 8.6 tons, and housed a crew of five, consisting of a driver, commander, gunner, and two machine gunners. Production on the model began in March 1915 to fill an initial order of 30 trucks for the army. The navy soon became interested and ordered 18 of its own but with a heavier chassis and thicker armor.

Though it offered good protection and firepower, the armored truck was slow, managing a top speed of 18 kph (11 mph), which was far slower than the armored cars it was supposed to support. Its range lagged behind the lighter armored cars at only 120 km (74 miles), and it was easily bogged down in poor conditions. Nevertheless, it proved useful in service, and both army and navy models saw combat against the Germans on a number of occasions. Some fell into German hands and were converted for their own use, continuing to see service after the war-suppressing uprisings back in the Fatherland. Other Putilov-Garford armored trucks saw action with both the Red and White Armies during the Russian Civil War. A final few remained in service all the way up to 1931, when the Communist government declared all World War I armored vehicles obsolete.

The Russian Revolution of 1917 put an end to all experimentation in tanks, but it also brought about a rise in the production of armored cars by both White and Red Armies. The White Army did get the desired, imported Allied tanks, but never in sufficient numbers to turn the tide of the Russian Civil War.

The United States was late to the conflict, declaring war on the Central Powers in April of 1917, but it had been closely following Allied technological developments. It had experimented with armored cars as early as 1916, pitting a single vehicle against Pancho Villa in that same year, but the country had done little to promote armored vehicles. The U.S. Tank Corps had adopted the use of the Renault FT and began development of its own vehicles, most notably the M1917—a variation of the Renault FT—but no American-designed tank saw action in the war.

Developing Tank Tactics and the Fate of World War I Tanks

After the successes of 1917, the high commands of all major armies were convinced of the usefulness of tanks and the Allies began to refine their tactics. On July 4 at Le Hamel, Australian General John Monash coordinated artillery, tanks, and aircraft to open a path for the infantry in a battle that would prove the Mark V's worth. Of the 60 Mark Vs present that day, all made it to the start line on time and without breaking down, which might have been a first.

Monash

Tank assaults became ever larger. From July 18-26, the French used 336 Schneiders, St. Chamonds, and Renaults to support a French and American infantry assault at Soissons to some success.

The biggest tank assault of the war came during the Battle of Amiens, which started on August 8, when 646 Allied tanks, mostly Mark Vs and V*s,

supported a 20 mile advance on the Western Front. Over the next three days, the Allies pushed the Germans back up to 12 miles (19 kilometers), inflicting heavy losses. The fierce fighting saw a large loss of tanks, the majority due to breakdowns or getting stuck, and German field gun crews became expert at knocking them out. Fatalities among tank crews were now on the rise.

A British assault at Bapaume on August 21, 1918, used three types of tanks. The Germans had thinned out their advanced positions to minimize damage from artillery barrages, and with the hope tanks might be taken out or bogged down before reaching the main defenses. To counteract this, the British first sent the older Mark IVs to take the German forward line, allowing the Mark Vs to move unscathed to the main defenses. Once the Mark Vs broke the line, the smaller, faster Whippet tanks poured through the gap to attack the Germans in the rear.

By the end of the war in November of 1918, Allied tank production was in high gear. If the war had continued into 1919, the German defenses would have been overrun by armor, but the Germans could hold out no longer, as they were critically short on men, food, and industrial capacity.

The war ended with the Allies having a vast superiority in technical know-how when it came to tanks, but the Germans would learn from this mistake and remedy it in the 1930s as the Nazis rearmed the nation. Their first attempts were small, light tanks like the Panzer I and II, which aimed to replicate the success of the Renault FT, before moving on to heavier tanks such as the Panzer III. Moreover, men on both sides would use their experience and the time between wars to revolutionize tank warfare, including the likes of Erwin Rommel, Heinz Guderian, and George Patton.

While the tanks of World War I were superseded in the interwar period, the Renault FT was used to fight the Germans during the invasion of France in 1940. Perhaps not surprisingly, it proved to be outmatched by the Panzer IIs and Panzer IIIs it faced, showing that while it had been one of the most successful models of the Great War, it had been outpaced by the maneuverability and firepower of the German tanks in the 1940s.

Despite this, many of the old armored car designs continued to be produced and used throughout World War II for fighting infantry, especially against

poorly armed partisans who did not have many antitank weapons. They also saw service in reconnaissance missions and as infantry support, as their speed and maneuverability were still useful on a more modern battlefield.

Perhaps the most surprising use of a World War I armored vehicle was in the waning days of the Third Reich. During the siege of Berlin in April and May of 1945, a British Mark V tank was pulled out of the city's military museum and put into service as a pillbox, but the fighting was so chaotic that no record was left detailing how this dinosaur performed in the last major battle of the war in Europe.

This would not be the last time a World War I tank would appear out of its time. When the United States invaded Afghanistan in 2001, they came across several Renault FTs. Details are vague, but photos circulated on the Internet clearly show Renault FTs, utilizing a longer cannon of uncertain origin. It's unknown how these museum pieces ended up in Afghanistan. Some speculate that they came by way of Russia, where several had served in the Russian Civil War, and others think they may have been French exports. The fact that they were still in running condition so many decades later is remarkable in its own right, a testament not only to the engineers of the 21st century but to the people who designed and created the tanks a century ago.

Online Resources

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